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10/530,965	04/11/2005	Kota Kitamura	12477/8	2370

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EXAMINER	
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ART UNIT	**PAPER NUMBER**
1796	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/530,965	KITAMURA ET AL.	
	Examiner	Art Unit	
	MICHAEL M. BERNSHTEYN	1796	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on *30 October 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,6-19,23,24 and 26-28* is/are pending in the application.

4a) Of the above claim(s) *1 and 8-19* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *6,7,23,24 and 26-28* is/are rejected.

7)☒ Claim(s) *6 and 7* is/are objected to.

8)☒ Claim(s) *1,6-19,23,24 and 26-28* are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11 April 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This Office Action follows a response filed on October 30, 2008. Claims 6, 7, 23, 24, 27 and 28 have been amended; claims 2-5 and 25 have been cancelled; no claims have been added

2. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on October 30, 2008 has been entered.

3. In view of amendment(s) and remarks the rejection of claims 2-7 and 23-28 under 35 U.S.C. 103(a) as being unpatentable over Formato et al. (U. S. Patent 6,248,469 or WO 9/10165) in view of Fukuda et al. (U. S. Patent Application Publication 2002/0076594 A1) and Sakuma et al. (JP 2000-256486 A), and the rejection of claims 2-4, 20 and 23-25 under 35 U.S.C. 103(a) as being unpatentable over Suzuki et al. (JP 2002-203576) in view of McGrath et al. (WO 02/25764) have been withdrawn.

4. Applicant's arguments with respect to claims 6, 7 and 23-28 have been considered but are moot in view of the new ground(s) of rejection.

5. Claims 1, 6-19 and 23-28 are pending; claims 6, 7, 23, 24 and 26-28 are active.

Specification

6. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Objections

7. Claims 6 and 7 are objected to because of the following informalities:

Claim 6 contains parenthesis after Chemical Formulas 2A and 2B and Chemical Formulas 4 and 6, which should be deleted.

Claim 7 contains parenthesis after Chemical Formulas 2A and 2B and Chemical Formulas 3 and 7, which should be deleted.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

8. Claims 6, 7, 23, 24 and 26-28 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Newly amended claim 6, lines 6 and 7, recites, "…at a ratio, Chemical Formula 2A : Chemical Formula 2B = n : m", and on line 7 it recites, "…m represent an integer

within a range of 0 to 1000". It means that if m = 0, the ratio gives unpredictable result (division by zero).

After Chemical Formulas 2A and 2B claim 6 recites the limitations for the substituenrts Ar_1 , Ar_2 , Ar_3 , m, and n, where "m represent an integer **within a range of 0 to 1000**" while the last paragraph of claim 6 recites, "…wherein said Ar_1 and said Ar_3 each are a linking unit represented by said Chemical Formula 6, said Ar_2 is a linking unit represented by said Chemical Formula 4, and said n and said **m each are an integer within a range of 1 to 1000**…" The following is not clear:

1) in which part of the composition the compounds of Chemical Formulas 4 and 6 should be used: instead of the compounds of Chemical Formulas 2A and AB, or together with these compounds?;

2) which is a proper range limitation for m within the same claim: from 0 to 1000 or from 1 to 1000?

Newly amended claim 7, lines 6 and 7, recites, "…at a ratio, Chemical Formula 2A : Chemical Formula 2B = n : m", and on line 7 it recites, "…m represent an integer **within a range of 0 to 1000**". It means that if m = 0, the ratio gives unpredictable result (division by zero).

After Chemical Formulas 2A and 2B claim 7 recites the limitations for the substituents Ar_1 , Ar_2 , Ar_3 , m, and n, where "m represent an integer **within a range of 0 to 1000**" while the last paragraph of claim 7 recites, "…wherein said Ar_1 and said Ar_3 each are a linking unit represented by said Chemical Formula 3, said Ar_2 is a linking unit

represented by said Chemical Formula 7, and said n and said **m each are an integer within a range of 1 to 1000**…" The following is not clear:

1) in which part of the composition the compounds of Chemical Formulas 4 and 6 should be used: instead of the compounds of Chemical Formulas 2A and AB, or together with these compounds?;

2) which is a proper range limitation for m within the same claim: from 0 to 1000 or from 1 to 1000?

Claim Rejections - 35 USC § 102

9. The text of this section of Title 35 U.S.C. not included in this action can be found in a prior Office Action.

Claim Rejections - 35 USC § 103

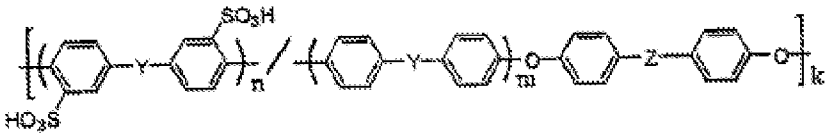
10. The text of this section of Title 35 U.S.C. not included in this action can be found in a prior Office Action.

11. Claims 6 and 7 are rejected under 35 U.S.C. 102(b) as being anticipated by McGrath et al. (WO 02/25764 or U. S. Patent Application Publication 2002/0091225).

With regard to the limitations of claims 6 and 7, McGrath discloses sulfonated copolymers and membranes that exhibit improved thermal stability as well as improved protonic conductivity in fuel cell applications.

McGrath discloses polymerizing a sulfonated activated aromatic monomer and an unsulfonated activated aromatic monomer with a suitable comonomer such as a bisphenol to produce a sulfonated aromatic copolymer.

McGrath discloses several embodiments, which include a sulfonated copolymer having the following chemical structure (page 3, line 4 through page 5, line 10):



where n/n+m ranges from about 0.001 to about 1. Y may be selected from the group consisting of -S-, S(O)-, $-S(O)_2-$, -C(O)-, $-P(O)(C_6H_5)-$ or combinations thereof. Z may be selected from the group consisting of a direct carbon-carbon single bond, $-C(CH_3)_2-$, $-C(CF_3)_2-$, $-C(CF_3)(C_6H_5)-$, -C(O)-, $-S(O)_2-$, and $-P(O)(C_6H_5)-$. In a preferred embodiment, n/n+m ranges from about 0.3 to about 0.6.

These structures are substantially identical and contain all the limitations of instant claims 6 and 7.

Furthermore, McGrath discloses that in preferred embodiment, n/n+m ranges from about 0.3 to about 6, which is clearly within the claimed ranges in Mathematical Expressions 2 and 3.

12. Claims 6, 7, 23, 24 and 26-28 are rejected under 35 U.S.C. 103(a) as being anticipated by Formato et al. (U. S. Patent 6,248,469 or WO 9/10165) in view of Fukuda

et al. (U. S. Patent Application Publication 2002/0076594 A1) and Sakuma et al. (JP 2000-256486 A).

With regard to the limitations of claims 6 and 7, Formato discloses a method of producing a membrane of the present invention comprises the steps of sulfonating the pores of the polymer substrate with a sulfonating agent (col. 8, lines 26-29). The composite SPEMs of the present invention comprise a porous polymer substrate interpenetrated with an ion-conducting material. The porous polymer substrate serves as a mechanically, thermally, chemically and oxidatively durable support for the ion-conducting material, e.g., polymer (col. 9, lines 14-19). The ion-conducting polymer substantially interpenetrates the micro infrastructure of the porous polymer substrate. This configuration, which can be made quite thin, promotes efficient proton transport across the membrane and minimizes water management problems. As a consequence, eventual membrane dehydration, parasitic losses and loss of ionic conductivity can be substantially prevented (col. 9, lines 30-35).

Formato discloses the corresponding structures for certain polymers, which are preferably used for the preparation of ion exchange resin (tables 4-7); which are substantially identical to the formulas of instant claims 6 and 7.

With regard to the limitations of claims 6 and 7, Formato does not disclose the composite ion exchange membrane wherein the thickness of each of side surface layers is within a range of 1 to 50 μm and also is within a range, which does not exceed half the total thickness of said composite ion exchange membrane, and wherein at least

one surface of said support membrane has an aperture ratio within a range of 40 to 95%.

Fukuda discloses the ion-exchange membrane having a thickness in a range of 5 μm to 200 μm, and the surface layer has a thickness equal to or smaller than 10 μm, which is within the claimed range (abstract, pages 1-2, [0016]).

Sakuma discloses a multi-layer ion exchange membrane having a high current efficiency and a low electric resistance is useful in alkali electrolysis wherein the aperture ratio is 70-90%, which is within the claimed ranges (abstract).

All three references are analogous art because they are from the same field of endeavor concerning new composite ion-exchange membranes.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to obtain Formato's composite ion exchange membrane with the thickness of the surface layers within the claimed range as taught by Fukuda and having the adjusted aperture ratio as taught by Sakuma in order to obtain an ion-exchange membrane making proof against leak of an electrolyte from its elution pores when used in an electrolytic cell, having a high current efficiency and a low electric resistance (JP'486, abstract), and which ensures that the power-generating performance of a fuel cell (US'594, page 1, [0006]), and thus to arrive at the subject matter of instant claims 6 and 7.

With regard to the mathematical expressions 1-3, instantly claimed in claims 6 and 7, the combined teaching of Formato, Fukuda and Sakuma is silent about it. However, in view of substantially identical structures of the polymers for ion exchange

compositions between the combined teaching of Formato, Fukuda and Sakuma and instant claims, it is the examiner position that Formato, Fukuda and Sakuma's composite ion exchange membrane possesses these properties. Since the USPTO does not have equipment to do the analytical test, the burden is now shifted to the applicant to prove otherwise. ***In re Best*** 95 USPQ 430, (CCPA 1977).

It is noted that it would have been obvious to one of ordinary skill in the art to make the polymer having the claimed properties for the composite ion exchange membrane because it appears that the reference generically embrace the claimed subject matter and the person of ordinary skill in the art would have expected all embodiments of the reference to work. Applicants have not demonstrated that the differences, if any, between the claimed subject matter and the subject matter of the prior art examples give rise to unexpected products.

With regard to the limitations of claims 23 and 24, Formato discloses a fuel cell that includes polymer electrolyte membrane, which comprises an ion-conducting resin interpenetrated into a porous polymer substrate (col. 5, lines 62-64). Preferred substrates include **polybenzazoles** (PBZ) such as polybenzoxazole (PBO), polybenzothiazole (PBT) and polybenzimidazole (PBI) (col. 6, lines 25-30, Table 4, col. 19). As seen in figure 1, the conductive resin not only fills the pores of the substrate, but also coats its **two surfaces**. The substrate has a porosity of about 40 to 90 percent (column 6, lines 22-24), which would give it an open surface porosity of at least 40 percent (Examples 9-13, col. 42, use PBO as the substrate polymer).

With regard to the limitations of claim 26, the combined teaching of Formato, Fukuda and Sakuma et al. does not disclose the content of polybenzazole-type polymer into the film.

Formato discloses that porous polymer substrate membranes containing an ion-conducting material can be produced by casting the membranes from a common solution containing appropriate concentrations of the polymer substrate and ion-conducting material. Determination of % wt. ion conductor/% wt. substrate is based on the desired final thickness, % volume of ion-conducting polymer and the particular polymers employed. The % wt. of the solution is adjusted to obtain the desired composite (col.16, lines 23-57).

It is noted that the above mentioned parameter is the result effective variable, and therefore, it is within the skill of those skilled in the art to find the optimum value of a result effective variable, as per ***In re Boesch and Slaney*** 205 USPQ 215 (CCPA 1980). See also *Peterson*, 315 F.3d at 1330, 65 USPQ2d at 1382: "The normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages."

With regard to the mathematical values of the variation in the number of X-ray counted, and the number of the analysis points where the number of the counted X-rays of the analyzed elements is 5% or less relative to the maximum number is within a range of 0 to 30% of the number of all the analysis points, instantly claimed in claims 27 and 28, the combined teaching of Formato, Fukuda and Sakuma is silent about it.

However, in view of substantially identical structures of the composite ion exchange membrane between the combined teaching of Formato, Fukuda and Sakuma and instant claims, it is the examiner position that Formato, Fukuda and Sakuma's composite ion exchange membrane inherently possesses these properties. Since the USPTO does not have equipment to do the analytical test, the burden is now shifted to the applicant to prove otherwise. ***In re Best*** 95 USPQ 430, (CCPA 1977).

It is noted that it would have been obvious to one of ordinary skill in the art to make the composite ion exchange membrane having the claimed properties because it appears that the reference generically embrace the claimed subject matter and the person of ordinary skill in the art would have expected all embodiments of the reference to work. Applicants have not demonstrated that the differences, if any, between the claimed subject matter and the subject matter of the prior art examples give rise to unexpected products.

13. Claims 6, 7, 23, 24 and 26-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Suzuki et al. (JP 2002-203576) in view of Fukuda et al. (U. S. Patent Application Publication 2002/0076594 A1) and Sakuma et al. (JP 2000-256486 A) and McGrath et al. (WO 02/25764 or U. S. Patent Application Publication 2002/0091225).

With regard to the limitations of claims 6 and 7, Suzuki discloses a composite ion exchange membrane comprising an ion exchange resin composition and a substrate membrane having open cells passing through the membrane wherein the substrate membrane is impregnated with the ion exchange resin composition (claim 1, page 1).

With regard to the limitations of claims 6 and 7, Suzuki does not disclose the usage of instantly claimed sulfonated aromatic copolymer, that the composite ion exchange membrane wherein the thickness of each of side surface layers is within a range of 1 to 50 μm and also is within a range, which does not exceed half the total thickness of said composite ion exchange membrane, and wherein at least one surface of said support membrane has an aperture ratio within a range of 40 to 95%.

Fukuda discloses an ion-exchange membrane having a thickness in a range of 5 μm to 200 μm, and the surface layer has a thickness equal to or smaller than 10 μm, which is within the claimed range (abstract, pages 1-2, [0016]).

Sakuma discloses a multi-layer ion exchange membrane having a high current efficiency and a low electric resistance is useful in alkali electrolysis wherein the aperture ratio is 70-90%, which is within the claimed ranges (abstract).

All the above references are analogous art because they are from the same field of endeavor concerning new composite ion-exchange membranes.

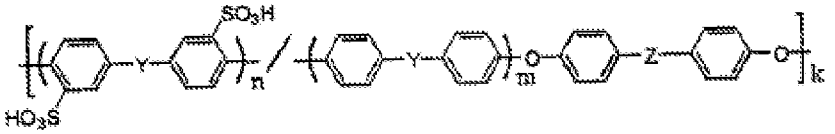
Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to obtain Suzuki's composite ion exchange membrane with the thickness of the surface layers within the claimed range as taught by Fukuda and having the adjusted aperture ratio as taught by Sakuma in order to obtain an ion-exchange membrane making proof against leak of an electrolyte from its elution pores when used in an electrolytic cell, having a high current efficiency and a low electric resistance (JP'486, abstract), and which ensures that the power-generating

performance of a fuel cell (US'594, page 1, [0006]), and thus to arrive at the subject matter of instant claims 6 and 7.

With regard to the limitations of claims 6 and 7, McGrath discloses sulfonated copolymers and membranes that exhibit improved thermal stability as well as improved protonic conductivity in fuel cell applications.

McGrath discloses polymerizing a sulfonated activated aromatic monomer and an unsulfonated activated aromatic monomer with a suitable comonomer such as a bisphenol to produce a sulfonated aromatic copolymer.

McGrath discloses several embodiments, which include a sulfonated copolymer having the following chemical structure (page 3, line 4 through page 5, line 10):



where n/n+m ranges from about 0.001 to about 1. Y may be selected from the group consisting of -S-, S(O)-, -S(O)$_2$-, -C(O)-, -P(O)(C_6H_5)- or combinations thereof. Z may be selected from the group consisting of a direct carbon-carbon single bond, -C(CH_3)$_2$-, -C(CF_3)$_2$-, -C(CF_3)(C_6H_5)-, -C(O)-, -S(O)$_2$-, and -P(O)(C_6H_5)-. In a preferred embodiment, n/n+m ranges from about 0.3 to about 0.6.

These structures are substantially identical and contain all the limitations of instant claims 6 and 7.

Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to incorporate sulfonated aromatic copolymer as taught by McGrath in combined teaching of Suzuki, Fukuda and Sakuma's composite ion exchange membrane in order to achieve improved thermal stability as well as improved protonic conductivity in fuel cell applications (WO'764, page 3, lines 5-6), and thus to arrive at the subject matter of instant claims 6 and 7.

With regard to the limitations of claims 23 and 24, Suzuki discloses that the support membrane contains a polybenzazole type polymer as a material (pages 5-6, [0042]).

Response to Arguments

14. Applicant's arguments filed on October 30, 2008 have been fully considered but they are not persuasive.

15. It appears that the focal Applicants argument resides in the contention that Formato, Fukuda and Sakuma, even when taken in combination, do not teach or suggest a composite ion exchange membrane comprising an ion exchange resin composition wherein Mathematical Expression 2 or 3, as recited in claims 6 or 7, is satisfied. Applicants contend that that where n/(n+m) satisfies Mathematical Expression 2 as recited in claim 6 or Mathematical Expression 3 as recited in claim 7, the composite ion exchange membrane has superior properties in terms of ion conductivity, swellability, and permeability of methanol. See page 26, lines 1-10 (page 12).

16. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., f ion conductivity, swellability, and permeability of methanol) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

17. In response to applicant's argument that neither Suzuki nor McGrath teaches or suggests a composite ion exchange membrane comprising an ion exchange resin composition having a n/n+m value that satisfies Mathematical Expression 2 or 3, as recited in claims 6 or 7 (page 13, paragraph 4), it is worth to mention that McGrath's references clearly anticipate the claimed Mathematical Expressions 2 and 3 (see paragraph 11 of current Office action).

18. Regarding Applicants arguments that the Office Action erroneously states that: "Claims 2-4, 20 and 23-25 are rejected under 35 U.S.C. 103(a) as being anticipated by Formato et al. (U.S. Patent 6,248,469 or WO 9/10165) in view of Fukuda et al. (U.S. Patent Application Publication 2002/0076594 A1) and Sakuma et al. (JP 2000-256486A)" (page 11, 1st paragraph), it is noted that it was obvious typing error, and certainly the rejection was made on obviousness grounds under 35 U.S.C. 103(a).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL M. BERNSHTEYN whose telephone number is (571)272-2411. The examiner can normally be reached on M-Th 8-6:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Randy Gulakowski can be reached on 571-272-1302. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Michael M. Bernshteyn/
Examiner, Art Unit 1796

/M. M. B./
Examiner, Art Unit 1796